

# Videoconferencing: what are the benefits for dental practice?

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**For more than 3 years members of the TeleDent team from Bristol University have been looking at the potential of videoconferencing technology for dentistry. Here they explain what videoconferencing is and how it can help the GDP. They discuss examples of its most promising uses for the profession, which include professional updating and providing diagnostic support at a distance. They describe the equipment that is needed, the different types of system available and give an indication of costs. A suggested procedure for using the technology for remote referrals is outlined. 'Store and forward' techniques are also discussed. These do not involve a live video but involve the sending of static electronic files. This approach is compared with videoconferencing, and the article looks at the question of which will be best suited to the GDP, and for what purposes.**

Increasing dental knowledge and patient expectation make it unlikely that tomorrow's GDPs will be able to solve all their clinical problems without help. Perhaps as many as 1,000 patients are referred for hospital-based specialist dental treatment every day, and this is likely to increase once consultant registers are fully established.

Videoconferencing is one of the most promising new technologies for exchanging the advice which dentists need. It can enable a wide range of communications formats, including live, 'real time' interaction between users at different locations, with moving images, still images of all kinds, sound and shared virtual workspaces. Both the new NHS Information Technology Strategy<sup>1</sup> and the Dearing Report<sup>2</sup> emphasise its potential for the delivery of healthcare and education. This article gives a brief introduction to videoconferencing and how it can be used by dentists, based on research being done in Bristol. It is intended as a follow-up to pre-

## In brief

- A discussion of videoconferencing and dataconferencing.
- The potential benefits for the general dental practitioner.
- The process of teledentistry: how case material can be prepared and presented.

vious articles in this publication describing the potential of the Internet for dental practice (for example Downes<sup>3</sup>).

For the past 3 years, TeleDent SW, a project at the University of Bristol Dental School, has been assessing and exploring communication technologies and how they can be used by both GDPs and consultants in their work. The project is a collaboration between the Department of Oral and Dental Sciences and the University's Institute for Learning and Research Technology.<sup>4</sup>

TeleDent is exploring training and diagnosis as two important uses of videoconferencing in dentistry. Most of the project work to date has focused on postgraduate training and informal assessment of its uses for diagnosis. Findings from this preliminary work have been fed into pilot schemes for diagnosis using videoconferencing, which are now being implemented in volunteer GDP surgeries.

## Basic terminology and techniques

There are currently two techniques loosely known as videoconferencing, which are normally used together, although they are technically quite different.

### Videoconferencing

Videoconferencing allows people at two or more sites to communicate with each other, not just by hearing each other's voices, as on a telephone, but by using a digital screen to display a video image of the person or people at the other site(s). These systems have fairly conventional handsets or loudspeaker phones and users have a video camera pointing at them so that the user(s) at the other site(s) can see them.

### Dataconferencing

Dataconferencing is a closely related technology which enables participants at two or more sites to have a shared work space on their computer desktops. This might be a shared 'whiteboard' where they can draw, write, or import and manipulate images. Or it might be 'application sharing', where a piece of software can be run and controlled by both users. Dataconferencing can be useful when users at different sites want to work together on documents such as reports or statistical data in a spreadsheet.

### ISDN

To use videoconferencing, it is necessary to have either internet access or preferably ISDN (Integrated Services Digital Network) lines. ISDN is a digital technology that provides a dial-up service (as with the telephone network), but the lines carry far more information, with minimal fluctuations in sound and picture quality.

Although the internet is an option, it is not able to support professional quality videoconferencing. However, dentists may like to experiment with using the internet for 'store and forward' (described later), which can be run over ordinary telephone lines.

## Using videoconferencing in dentistry

### Telediagnosis: transmitting and discussing cases

Videoconferencing has already been used to carry out remote diagnosis in the fields

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of radiology,<sup>5</sup> dermatology,<sup>6</sup> and psychiatry.<sup>7</sup> Initial trials with teliagnosis in dentistry are focusing on orthodontic case assessment.

Because of the work done for TeleDent's pilot studies with dentists in training, it is possible to predict some of the advantages offered by diagnosis using videoconferencing. The most obvious is being able to ask questions as they arise, because a 'live link' offers the chance to discuss case notes and materials directly with the consultant. Another will be the extra clarity offered by the consultant's sketches over the usual written report. The use of digitised case materials means that models and radiographs do not have to be sent by post, and the notes and sketches from the session are available to refer to later.

Similarly, the consultants may discover a range of advantages. For example, because they can download complete case notes, there will be no need to send patients for repeat x-rays or radiographs when these are delayed in the post. They will be able to request models in advance online. And they will save time on paperwork because they will not have to write a letter to the dentist, who makes notes during the session.

Ultimately, it is hoped that a wide take-up of videoconferencing in dentistry will mean improvements for everyone. It should mean that only patients who really need to be seen go on to waiting lists, and the instant feedback on the prognosis of individual teeth should speed up decisions about further treatment. For the patients, the main benefits are the savings in travel time and avoiding hospital stays, but everyone benefits from shorter waiting lists.

It should be pointed out, however, that at present the medico-legal status of teledentistry is unclear. There is as yet no case law to indicate the standing of advice received by remote means.

### Training

With the increasing demand for distance learning and CME, as well as the ever increasing pressure on both GDPs' and consultants' time, there is considerable potential for ISDN-based technologies to deliver training. TeleDent has successfully conducted teaching sessions with videoconferencing in a variety of formats and with several different audiences. These have

included mock vivas with final year undergraduates, seminars with VT trainees, and sessions for senior house officers preparing for the MFDS examination. Videoconferencing also enabled VDPs in Bristol and Taunton to participate in the Faculty of General Dental Practitioners' meeting on 'The Cracked Tooth', held at the Royal College of Surgeons last year (made possible with the assistance and facilities of the Raven Postgraduate Centre).<sup>1</sup>

On the whole, feedback from the trainees was positive. It is evident that presenters need to be very well prepared and to adapt their style to the technology. But it is clear that, given the emphasis on CME within the NHS, the possibility of receiving education at a local centre or even in the practice will become increasingly appealing.

### Other uses in the surgery

There are a number of other uses for videoconferencing equipment in the surgery. The most obvious are:

- Peer review groups
- Meetings
- Audit.

### What equipment is needed?

In addition to ISDN lines, some specialised equipment is required. There are

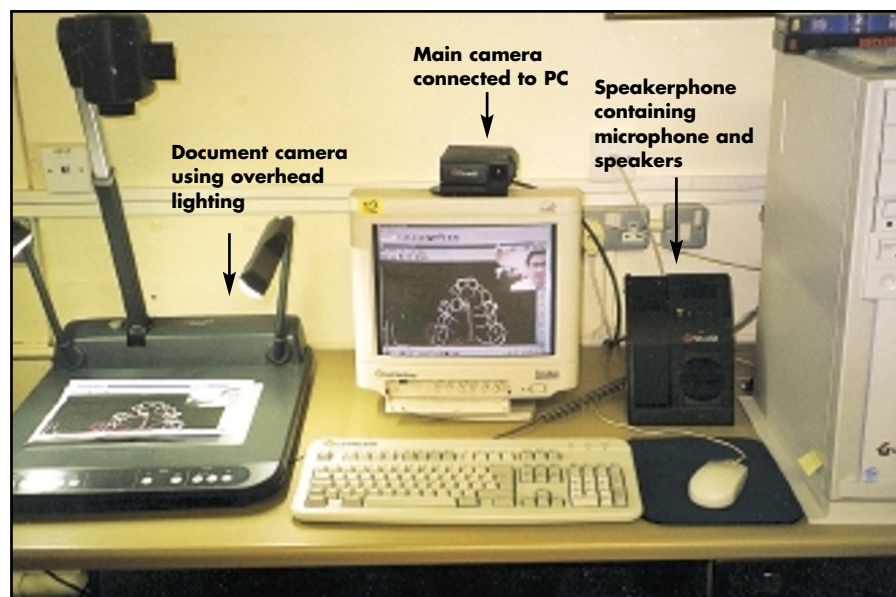
two main types of videoconferencing system and the one selected will depend on whether the objective is to run sessions with a number of participants or with individuals. For single users, a 'desktop' system can be connected to a PC, but for larger numbers of participants a 'group' system will be selected.

### Desktop systems

Desktop systems have a small video camera, placed on top of the PC and pointing at the operator, in order to give an outgoing picture to the 'remote' site (Fig. 1). (They also display a window on your screen showing the outgoing image.) Desktop systems have a microphone to pick up and transmit sound and they include software which makes the connections and displays the incoming and outgoing pictures on the computer screen. Desktop systems can be an effective way to support remote diagnosis because they are designed for use by one person.

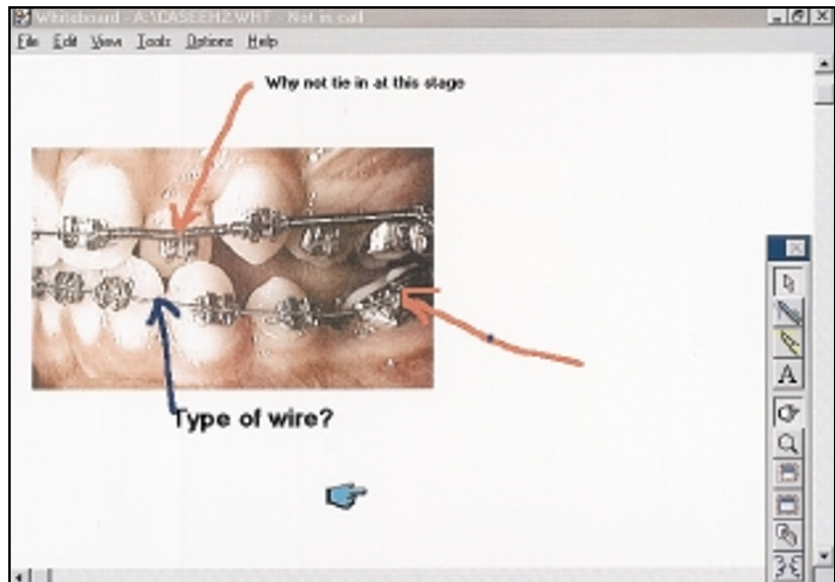
### Group systems

Group systems represent a greater investment and may be most appropriate for working in larger groups, such as for training sessions. They tend to be dedicated systems, with an extra large monitor and a



**Fig. 1 Desktop videoconferencing system with document camera**

**Fig. 2 A case on a whiteboard under discussion**



microphone, which can be placed in the middle of a room and will pick up voices from any position. The video camera is controlled remotely and can be 'preset' to a number of positions, enabling users at either end of the link to zoom in on a particular speaker. The latest versions can automatically track and focus on the most recent speaker.

**The document camera**

There are a number of additional pieces of equipment which can complement the basic set-up, such as an intra-oral camera or a scanner. Perhaps the most useful is the document camera (Fig. 1), which can be used to present printed materials and 3-D objects such as study models, plaster casts, pieces of equipment and so on, as well as offering another way of displaying flat objects. It has a flat bed, which can be illuminated, with adjustable arms holding the camera and lights above it. Using the back-lighting, radiographs and slides can be lit from below, whereas objects and photographs can be lit from above.

Document cameras have zoom and focus controls, including autofocus, and their high quality means that they can zoom in close enough to see 35 mm slides or very small objects. It is also possible to display quite large models, up to the size of a whole skull.

**The whiteboard facility**

The whiteboard is not a piece of equipment like the document camera, but an interactive facility in the software. Each page is a blank white space that is shared with the people at the other end of the call. There are tools for drawing diagrams, inserting images and typing text that enable interaction in real time. Whatever is done at one end is seen at the other, and can be annotated, amended or even deleted remotely. The whiteboard is available with most videoconferencing software, as well as with Microsoft Netmeeting, which comes bundled with Windows 95 and NT, so this is already on the PC.

The whiteboard is very well suited to presenting cases, as it can accommodate imported images, text and drawings on multiple pages to form a 'book' of the case. Slides, x-rays, photographs, images of 3D

objects and any other flat materials can be mounted on the whiteboard. In this way, the GDP can prepare case materials in advance of a consultation and display them directly on the consultant's PC during the live link-up. Both participants can see, point to and comment on the materials, even marking and highlighting them to illustrate their discussion (Fig. 2). Whiteboard files can be saved as records and for editing later.

**Preparing case materials for remote diagnosis**

For most GDPs, the main benefit of videoconferencing will be the chance to discuss the case directly with the consultant, what might be called 'remote diagnosis' or telediagnosis. It is advisable to prepare resources and materials in advance as far as possible, and to check the quality of any visual materials used.

**Snapshots**

Videoconferencing software makes it very easy to take snapshots or stills of models or 3-D case materials. Depending on which system is being used (and TeleDent has found the PictureTel Live 200 system to be reliable and easy to use, although high quality is also available from other manufacturers such as Sony, VTEL, and Mvision), it will probably have a 'snapshot' icon which can simply be clicked to save and prepare still images. As an alternative to the snapshot facility it is possible to import images into a whiteboard using any kind of digital stills camera.

The crucial factor in creating high quality images seems to be lighting. For dental casts and photographs, TeleDent recommends using the available light in the room, which lights them more evenly than the lights on the document camera. For radiographs, x-rays and slides, any overhead lighting should be switched off and if using a docu-

ment camera the back lighting facility should be used.

**Models**

In the pilot studies, TeleDent found that study models in white plaster are difficult to use and that models in artificial stone are best for videoconferencing. For photographing most models, best results come from using a dark or black background. With good room lighting, it should not be necessary to use any of the lighting on the camera itself, but if it is, the lights can be moved around in order to get the best definition. It is also essential that models are absolutely still to be photographed, so a clamp or cradle may be used to hold them.

**Importing files**

One more facility deserves particular mention. It is possible to use existing files — any digital material, be it image, video, sound, or text — which might want to be included in the case materials or sent to the consultant. Any such file can be imported into a whiteboard or presentation, saved to the hard drive, and edited as required.

**Remote diagnosis**

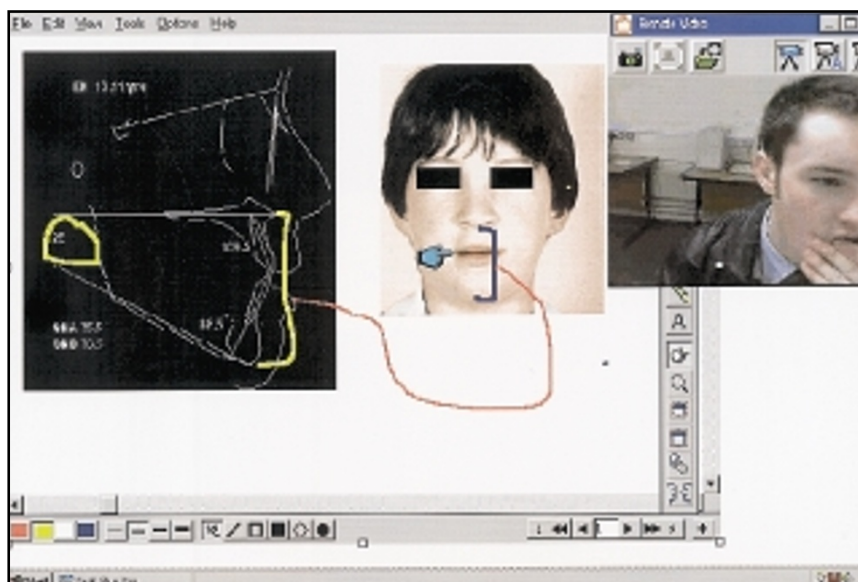
When the case materials have been prepared, they can be used for remote diagnosis by videoconferencing in a 'live link-up', or sent electronically to the consultant using 'store and forward'.

**The 'live link up'**

A typical live link up goes something like this. The GDP and consultant arrange the date and time for the consultation, probably by email. Then:

- They establish a 2-way link at the arranged time
- They transmit the whiteboard (this may

**Fig. 3** The desktop videoconferencing screen with whiteboard and live video windows



take a few minutes, during which the problem can be outlined verbally by the referring dentist)

- The images appear in sequence and so, as soon as the first has arrived, the assessment and treatment planning can begin. Generally it is most convenient for the consultant to control the whiteboard
- The GDP and consultant discuss the case; both can add comments or amend details already entered, point to, or verbally clarify any points
- Agreement is reached on the assessment and treatment plan. These and any actions to be taken are noted on the whiteboard. Both users then save the agreed file to their hard disks and terminate the call.

The value of the live video element in videoconferencing will be very clear to dentists wanting to treat orthodontic cases themselves and in need of detailed advice. Personal contact can make a lot of difference when receiving advice from an unfamiliar consultant. The ability to clarify points verbally and discuss aspects of the case informally makes videoconferencing the closest a GDP can get to a direct consultation (Fig. 3).

#### 'Store and forward'

Instead of linking up in 'real time' using videoconferencing, the GDP can send the case data electronically to the consultant. 'Store and forward' does not allow the personal contact or interaction that videoconferencing does, but it can be useful. The whiteboard facility is just as effective as a way of presenting cases as it is in a live link-up.

A set of whiteboards describing several cases can be sent to the consultant by email, FTP or any other appropriate electronic transmission protocol. The whiteboards or individual images can be annotated and drawn on, just as with the videoconferencing link. The consultant can look at and assess the cases in his or her own time, returning the files with the advice attached.

For many GDPs, the limitations of the 'store and forward' option may be acceptable, since it can be difficult to arrange convenient times for a live link-up. It also has the advantage of requiring less complicated equipment: it does not require ISDN and can be done over the

internet, using ordinary telephone lines. However, without videoconferencing there will not be the camera and software to capture snapshots, so an alternative way of capturing images will be necessary. A scanner will be good for flat objects, but a digital camera will be needed to capture images of 3D objects, such as models. Most importantly, without videoconferencing the advantage of live interaction with the consultant is not possible, preventing discussion of the case and clarification of points as they arise.

#### How much does it all cost?

Videoconferencing used to be an expensive technology but recent advances mean that the price has fallen dramatically, so that a desktop system will be within reach of many GDPs. Two years ago, it would have cost £1,100 to purchase the software and hardware, with another £400 for ISDN line installation. Now, it costs £800 for the software and hardware, while ISDN lines are available for £200. However, at £88 per quarter the ongoing rental of ISDN lines is still relatively expensive. If only the 'store and forward' is used then it could run on the internet without the ISDN lines, and the use of an analogue telephone line (although it might be slow) or a cable line is a possibility.

These costs are in addition to the cost of a Pentium PC with 32 Mb RAM, as well as any peripherals, such as a document camera or scanner, and annual maintenance contracts (normally about 7% of the purchase price). However, they do indicate that videoconferencing is rapidly becoming an affordable technology.

#### Conclusions

As with any technology or equipment, the choice should be determined by how it is intended to be used. There is little point investing in a group system, which will cost thousands of pounds, unless there is a sig-

nificant amount of group work with colleagues or students at other locations. But a desktop system will support most communications technologies and could transform the way advice is received when referrals are made.

The TeleDent SW team has found that the immediate core benefits of videoconferencing are the savings in time and travelling expenses, the direct communication between GDP and consultant and the ability to store and record case materials electronically. It is hoped that the longer term will reveal further benefits; such technologies can be expected to have a positive impact on waiting lists in the future. Most importantly, videoconferencing allows the consultant to stay in the dental school and concentrate on providing advice, and the GDP to stay in the surgery and concentrate on the patients.

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